

REMARKS

Claims 1-6 and 22-34 are pending. Claims 25 and 32 are amended to place them in independent form by incorporating all the limitations from the claims from which they formerly depended.

Rejection under 35 U.S.C. §103(a) as unpatentable over Hepp et al. (U.S. Pat. No. 3,461,183) in view of Schuh et al. (WO 99/15715)

Claims 1-6 and 23-34 have been rejected under 35 U.S.C. §103(a) as unpatentable over Hepp et al. in view of Schuh et al. This rejection is respectfully traversed.

Even if there were a motivation to combine the cited references, all of the pending claims are nonobvious over the prior art due to applicants' showing of superior and unexpected results. In the application, Fig. 2 shows the results of conducting a water-gas shift reaction over the powdered catalyst. Fig. 3 shows the results of conducting a water-gas shift reaction over a catalyst including a large pore support (either a foam (Δ) or a felt (\diamond)). The superior performance can be seen clearly by comparing these two figures. The catalyst having the large pore support unexpectedly exhibited better CO conversion at low temperature. This superior performance over a powder was surprising in view of the prior art and establishes patentability of all of the pending claims (which all recite a large pore support).

Claim 32 is additionally patentable in view of applicants' showing of superior and unexpected results as compared with either a powder or a foam. The comparison of a felt support versus a foam support is shown in Fig. 3. The felt supported catalyst exhibited superior CO₂

selectivity.

Independent Claim 25 is additionally patentable because it recites a zirconia support having relatively high surface area. Even if surface area were a result effective variable, it would not have been obvious to adjust the Hepp catalyst to obtain a high surface area. To the contrary, the Hepp catalyst is designed to operate for catalyzing the dehydrogenation of alkanes at high temperatures and in the presence of steam. Under these conditions it is well known that high surface area supports are not stable. Attached to this amendment is a Declaration by Dr. Richard Long stating that at high temperatures in the presence of steam, it would have been known that zirconia would have dramatically lost surface area and could have also undergone a phase transition. The abstract of a scientific article reporting zirconia's phase transition is also attached. In view of zirconia's known instability under the intended conditions for Hepps' catalyst, Dr. Long concludes that it would not have been obvious to use a high surface area zirconia. Thus, applicants have presented factual and testimonial evidence that a high surface area zirconia catalyst would have been undesirable in the process of Hepp et al.

Furthermore, Hepp et al calcine (850 F, 450 C) and reduce (1000 F, 540 C) their catalyst at much higher temperatures than in applicants' catalyst synthesis. This will result in a relatively low surface area in Hepps' catalyst.

Claims 5, 6, 30, 31, 33, and 34 are additionally patentable because they recite water-gas shift catalyst activities that are not suggested nor inherently possessed by Hepp's catalyst.

There is no suggestion to improve Hepps' catalyst for better water-gas shift catalyst activity. The catalyst of Hepp et al. was designed for alkane dehydrogenation. Therefore, it would not have been obvious to modify Hepp's catalyst to obtain better water-gas shift catalyst activity.

The claimed properties are not inherent in Hepps' catalyst. Attached to this Amendment is a Declaration by Dr. Hu stating that:

The catalysts made in the examples of the captioned application were calcined in air at 350 °C and reduced in H₂ at 110 °C. In contrast, the catalysts in U.S. Patent No. 3,461,183 were calcined at 850 °F (450 °C) and reduced in H₂ at 1000 °F (540 °C). These are significantly different conditions and would be expected to produce Ru/K/support catalysts having different properties, even if the catalysts had the same elemental composition. Therefore, I would not expect a catalyst, synthesized in the manner described in U.S. Patent No. 3,461,183, to inherently possess [the claimed properties]. . . . More specifically, I would expect the higher synthesis temperatures to result in a catalyst with lower activity.

Also attached is a literature reference showing "one example of the well known fact that the methods of making and activation procedure for a catalyst change the properties of catalysts, even where the catalysts have the same elemental composition." Thus, applicants have presented factual and testimonial evidence that the claimed properties are not inherent in Hepp's catalyst. Therefore, claims 5, 6, 30, 31, 33, and 34 are patentable over the prior art.

Accordingly, withdrawal of the section 103 rejection is respectfully requested.

Rejection under 35 U.S.C. §103(a) as unpatentable over Hepp et al. (U.S. Pat. No. 3,461,183) in view of Schuh et al. (WO 99/15715) and further in view of Hiramatsu et al. (EP 480,461).

Claim 22 has been rejected as above and further in view of Hiramatsu.

This rejection is traversed for the reasons discussed above with regard to Hepp and Schuh.

CONCLUSION

If the Examiner has any questions or would like to speak to Applicants' representative, the Examiner is encouraged to call Applicants' attorney at the number provided below.

Respectfully submitted,

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